

# NEC



## NATIONAL ELECTRICAL CODE

BY AHMED ABD EL MEGEED ISMAIL  
AT WWW.SAYEDSAAD.COM

## **LEC#5**

### **DEMAND FACTOR & DEMAND LOAD PART 3**

**STANDARD (GENERAL) METHOD LOAD CALCULATION FOR MULTI-FAMILY DWELLING UNITS EXA-D2  
(1.25 RULE) (LARGE EXAMPLE 4 PAGES)**

**(1.25 RULE) EXAMPLE**

**SAMPLE LOAD CALCULATION-COMBINED (HOSPITAL BUILDING, HOTEL BUILDING, OFFICE BUILDING  
DWELLING UNITS BUILDING) ND1 (LARGE EXAMPLE 6 PAGES)**

## DEMAND FACTOR & DEMAND LOAD PART3

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(مثال تطبيقي هام لوحدات سكنية توضح الطريقة العامة لحساب الأحمال بها)  
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**SAMPLE LOAD CALCULATION-COMBINED (HOSPITAL BUILDING, HOTEL BUILDING, OFFICE BUILDING DWELLING UNITS BUILDING) ND1 (LARGE EXAMPLE 6 PAGES)**

(مثال تطبيقي هام جدا جدا لوحدات غير سكنية توضح الطريقة العامة لحساب الأحمال بها)

# STANDARD (GENERAL) METHOD LOAD CALCULATION FOR MULTI-FAMILY DWELLING UNITS

## LINE 1

A - Lighting = 3000 VA  $\Rightarrow 120\ 000\ KVA = 3000\ KVA \times 40\ unit$   
 B - Sockets = 4000 VA  $\Rightarrow 160\ 000\ KVA$   
 C - Washing machine = 1000 VA  $\Rightarrow 40\ 000\ KVA$   
 D - Refrigerator = 500 VA  $\Rightarrow 20\ 000\ KVA$   
 **$= A + B + C + D = 120 + 160 + 40 + 20 = 340\ 000\ VA$**

## LINE 2

E - Water heater = 2000 VA  $\Rightarrow 80\ 000\ KVA$   
 F - Dishwasher = 2000 VA  $\Rightarrow 80\ 000\ KVA$   
 G - Garbage disposer = 800 VA  $\Rightarrow 32\ 000\ KVA$   
 H - Freezer = 1000 VA  $\Rightarrow 40\ 000\ KVA$   
 **$= E + F + G + H = 80 + 80 + 32 + 40 = 232\ 000\ VA, 4 \times 40 = 160\ equip$**

## LINE 3

I - Clothes dryer = 5000 VA  $\Rightarrow 200\ 000\ VA, 1 \times 40 = 40\ equip$

## LINE 4

J - Range = 2000 VA  $\Rightarrow 80\ 000\ VA, 1 \times 40 = 40\ equip$

## LINE 5

K - Outdoor condensing unit 4000 VA, indoor fan coil unit = 500 VA with heater coil 3000 VA

L - Outdoor condensing unit 3000 VA, indoor fan coil unit = 300 VA with heater coil 2000 VA

M - Lobby HVAC summer 10000 VA

**$= K + L + M\ (summer) = 4500 \times 40 + 3300 \times 40 + 10000 = 322\ 000\ VA$**

**$= K + L + M\ (winter) = 3500 \times 40 + 2300 \times 40 = 222\ 000\ VA$  as  $322000 > 232000 \Rightarrow HVAC = 322\ 000\ VA$**

## LINE 6

N - 3# elevator each elevator 10000 VA  $\Rightarrow 30\ 000\ KVA$

## LINE 7

O - 3# water pumps each 10000 VA  $\Rightarrow 30\ 000\ KVA$

مثال D2

عمارة سكنية بها 40 شقة اجمالها  
 كالاني مضاف اليها 3 مصاعد  
 و 3 ظلميات مياه بالرخاء حساب  
 الكابل العمومي والقاطع  
 العمومي للوحة العمومية وسعة  
 المحول.





Derating factor = 0.8, 400V 3PH

$$215.2(A)(1)$$

Cable size selection VA =====>

=Continuous load X 1.25+non continuous load X1+25% of largest motor = **753.950 KVA**

continuity ملحوظة هامة جدا هذا الكابل بحسب مفاضة نوع ال rule في حالة ان الكابل لم يتسحق بمحول اما حاله ان يتسحق محول نراه فيما بعد عند حساب الكابل قبل وبعد المحول

=====> cable 3 parallel **240 MM2**  
215.3

Breaker size selection VA =====> = Continuous load X 1.25+non continuous load X1+25% of largest motor = **753.950 KVA**

=====> breaker **1250 A**

Transformer size selection KVA =====> = Continuous load X 1.25+non continuous load X1+25% of largest motor = 753.950 KVA ==> nearest transformer size **800 KVA**

Design Load after Cont. & non-conti. loads .

**753.95**

Conductor type

Copper

Total Correction factor

KT

0.8

## CABLE AND CIRCUIT BREAKER SELECTION

Current after derating (Amp)

1090

Continuous loads x125% + non-continuous loads x100% -for Feeder

Continuous loads x125% + non-continuous loads x100% -for C.B

Circuit breaker size

**1250**

AT

Cable size

**240**

mm2

No. of parallel cables /ph

**3**

Cable selection current (Amp)

**1362**

C.B selection current(Amp)

1090

**1250**

AF

Total catalogue Ampacity

1488

Amp

Adjusted Ampacity

**1190**

Amp

**ملحوظة هامة** جدا في كثير من الدول خاصة الدول العربية يلجأون الى تأمين انفسهم وعدم الفصل بين الاحمال ال Continuous وال Non Continuous واعتبار كل الاحمال Continuous وبالتالي نضرب بعد ال Demand مباشرة في 1.25 في كل الاحمال اسم هذه القاعدة (**1.25 RULE**) ومن هنا نتعرف على سر هذا الرقم الذي دائما استخدمناه منذ بدنا العمل في التصميم والكثير لا يعرفو لماذا ؟؟؟؟ هذا الكلام لحساب الكابل والقاطع والمحول وايضا المولد وهذا طبعا يتسبب في كابل كبير وقاطع كبير وبالتالي لوحة كبيرة (هذا ابتداء من اللوحات الصغيرة الى اللوحة العمومية) وغرف كهرباء اللوحات كبيرة ومحول كبير ومولد كبير و ايضا غرف كبيرة لكل من المحول والمولد وزيادة في تكلفة المشروع البك نفس المثال السابق بعد جعل كل الاحمال Continuous طبعا لا يوجد 25% لا كبير موتور لان كل الاحمال مضروبة 1.25

line NO.	LOAD TYPE (1.25 RULE)	Connected load	No of equip.	DEMAND LOAD	X 1.25 for cont. or 1 X non cont	continuity	125% OR 100%	Table or Article section
9	Socket Non-Dwelling	5,000		5,000	6,250	Continuous	1.25	220.44
5	HVAC	322,000		322,000	402,500	Continuous	1.25	220.60
6	ELEVATOR	30,000	3	27,000	33,750	Continuous	1.25	620.14
7	MOTOR or PUMP	30,000		30,000	37,500	Continuous	1.25	
1	LIGHTING gen. socket ,Small appliances,Laundry,Refrigerator Dwelling	340,000		98,950	123,688	Continuous	1.25	220.42 I
11	LIGHTING guest room,Small appliances,Laundry					Continuous	1.25	220.42 II
12	LIGHTING patient room					Continuous	1.25	220.42 III
8	LIGHTING Non-Dwelling,Sign lighting,Show window lighting	14,000		14,000	17,500	Continuous	1.25	220.42 V
18	LIGHTING for Stage Sets Non-Dwelling					Continuous	1.25	530.19(A)
4	Range <3.5 kva Dwelling	80,000	40	24,000	30,000	Continuous	1.25	220.55 I
3	Cloth dryer Dwelling	200,000	40	53,000	66,250	Continuous	1.25	220.54
2	Dwelling appliance	232,000	160	174,000	217,500	Continuous	1.25	220.53
13	Kitchen equipment Non-Dwelling					Continuous	1.25	220.56
14	Computer,ups,telecom sockets Non-Dwelling					Continuous	1.25	
15	Cranes and Hoists					Continuous	1.25	610.14(E)
16	Welder					Continuous	1.25	630.11(A)
10	25% largest motor							
17	Xray					Continuous	1.25	517.73(2)
	<b>TOTAL</b>	<b>1,253,000</b>		<b>747,950</b>	<b>934,938</b>			



Derating factor =0.8, 400V 3PH

Cable size selection VA =====>

=all demand loads X 1.25 = 934.9 KVA

=====>CABLE 3 parallel 300 MM2

Breaker size selection VA =====> = all demand loads X 1.25 =934.9 KVA

=====> breaker 1600 A

Transformer size selection kVA =====> = all demand loads X 1.25 = 934.9 KVA ==> nearest transformer size 1000 KVA

ملحوظة هامة في الشكل FT-D بالرجاء مراعاة ان اللوحة الخاصة بالمصاعد MCC-E عند الحساب الكابل العمومي لها والقاطع لاينطبق عليها ال Continuity Rule بل لول قاعدة Elevator Rule ال 420.14 للكابل العمومي و 430.52 للقاطع العمومي كما هو في المنال رقم 1 E L V اما عند حساب الاحمال عند اللوحة العمومية MDB-D تصبح المصاعد اجباري تحت قانون Continuity Rule

Design Load after Cont. & non-contl. loads .		934.00	Conductor type		Copper
			Total Correction factor		KT 0.8
<b>CABLE AND CIRCUIT BREAKER SELECTION</b>					
Current after derating (Amp)	1350	Cable selection current (Amp)	1687		
Circuit breaker size	1600 AT	C.B selection current(Amp)	1350		
Cable size	300 mm2		1600 AF		
No. of parallel cables /ph	3	Total catalogue Ampacity	1713 Amp		
		Adjusted Ampacity	1370 Amp		

# SAMPLE LOAD CALCULATION-COMBINED (HOSPITAL BUILDING, HOTEL BUILDING, OFFICE BUILDING DWELLING UNITS BUILDING)

**LINE 1**  
lighting gen. socket ,small appliances,laundry,refrigerator dwelling = **340000 VA**

**LINE 2**  
= dwelling appliance s= **232000 VA** ,  $4 \times 40 = 160$  equip.

**LINE 3**  
clothes dryer = 5000 VA  $\Rightarrow$  **200000 VA** ,  $1 \times 40 = 40$  equip.

**LINE 4**  
range = 2000 VA  $\Rightarrow$  **80000 VA** ,  $1 \times 40 = 40$  equip.

**LINE 5**  
= HVAC(SUMMER)= $4500 \times 40 + 3300 \times 40 + 10000 = 700000$  VA  
= HVAC(WINTER)= $3500 \times 40 + 2300 \times 40 = 480000$  VA as  $700000 > 480000 \Rightarrow$  HVAC = **700000 VA**

**LINE 6**  
9# elevator each elevator 10000 VA  $\Rightarrow$  **90000 KVA**

**LINE 7**  
9# water pumps each 10000 VA  $\Rightarrow$  **90000 KVA**

**LINE 8**  
(lighting non-dwelling , sign lighting, show window lighting)  $\Rightarrow$  **300000 VA**

**LINE 9**  
(general use Socket Non-Dwelling)  $\Rightarrow$  **60000 VA**

**LINE 10**  
25% of largest Motor(one compressor in the chiller=20000VA)=  $\Rightarrow$  25% of 20000 = **5000 VA**

**ND1** ٤٣١٤

مبنى به 40 شقة سكنية كما هو  
بحواره مبنى به بالمنازل السابق  
ثلاثة ادوار ادارى مكاتب و بحواره  
مبنى 3 ادوار مستشفى 20  
غرفة مريض للدور و بحواره  
مبنى ثلاثة ادوار فندق به 20  
غرفة للدور مضاف اليها 9 مصاعد  
و 9 طلمبات مياه بالرجاء حساب  
الكابل العمومي والفاطع  
العمومي للوحة العمومية وسعة  
المحول الموضوعين فى غرفة  
خارجية هو واللوحة العمومية.

**LINE 11**

LIGHTING guest room, sockets guest room = 60000VA

**LINE 12**

LIGHTING patient rooms, sockets patient rooms = 72000VA

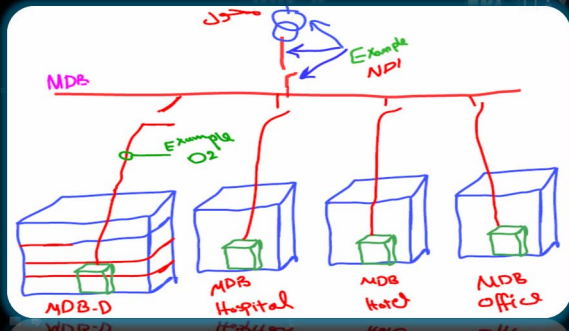
**LINE 13**

Kitchen equipment Non-Dwelling ----&gt; 50000VA . 20 equip.

**LINE 14**

Computer,ups,telecom sockets Non-Dwelling ----&gt; 20000va . 20 equip.

ND1 J L 1 1 1 1



line NO.	LOAD TYPE	Connected load	No of equip.	DEMAND LOAD	X 1.25 for cont. or 1 X non cont	continuity	125% OR 100%	Table or Article section
9	Socket Non-Dwelling	60,000		35,000	35,000	Noncontinuous	1	220.44
5	HVAC	700,000		700,000	700,000	Noncontinuous	1	220.60
6	ELEVATOR	90,000	9	65,700	65,700	Noncontinuous	1	620.14
7	MOTOR or PUMP	90,000		90,000	90,000	Noncontinuous	1	
1	LIGHTING gen. socket ,Small appliances,Laundry,Refrigerator Dwelling	340,000		98,950	98,950	Noncontinuous	1	220.42 I
11	LIGHTING guest room,Small appliances,Laundry	60,000		26,000	26,000	Noncontinuous	1	220.42 II
12	LIGHTING patient room	72,000		24,400	24,400	Noncontinuous	1	220.42 III
8	LIGHTING Non-Dwelling,Sign lighting,Show window lighting	300,000		300,000	375,000	Continuous	1.25	220.42 V
18	LIGHTING for Stage Sets Non-Dwelling					Continuous	1.25	530.19(A)
4	Range <3.5 kva Dwelling	80,000	40	24,000	24,000	Noncontinuous	1	220.55 I
3	Cloth dryer Dwelling	200,000	40	53,000	53,000	Noncontinuous	1	220.54
2	Dwelling appliance	232,000	160	174,000	174,000	Noncontinuous	1	220.53
13	Kitchen equipment Non-Dwelling	50,000	20	32,500	32,500	Noncontinuous	1	220.56
14	Computer,ups,telecom sockets Non-Dwelling	20,000		20,000	25,000	Continuous	1.25	
15	Cranes and Hoists					Noncontinuous	1	610.14(E)
16	Welder					Noncontinuous	1	630.11(A)
10	25% largest motor				5,000			
17	Xray					Noncontinuous	1	517.73(2)
	<b>TOTAL</b>	<b>2,299,000</b>		<b>1,643,550</b>	<b>1,728,550</b>			

101VI

3'300'000

1'643'550

1'738'220

ND1

Derating factor =0.8, 400V 3PH

$215.2(A)(1)$

Cable size selection VA =====>

=Continuous load X 1.25+non continuous load X1+25% of largest motor = **1729 KVA**

=====>cable **6 parallel 300 MM2**

Breaker size selection VA ==215.3==> = Continuous load X 1.25+non continuous load X1+25% of largest motor = **1729 KVA**

=====> breaker **2500A**

Transformer size selection kVA =====> = Continuous load X 1.25+non continuous load X1+25% of largest motor = **1729 KVA** ==> nearest transformer size **2000 KVA**

Design Load after Cont. & non-contl. loads .		1729.00			Conductor type	Copper
					Total Correction factor	KT 0.8
<b>CABLE AND CIRCUIT BREAKER SELECTION</b>						
Current after derating (Amp)		2499	Cable selection current (Amp)		3123	
Continuous loads x125% + non-continuous loads x100% -for Feeder						
Continuous loads x125% + non-continuous loads x100% -for C.B						
Circuit breaker size	2500	AT	C.B selection current(Amp)	2499	2500	AF
Cable size	300	mm2	Total catalogue Ampacity	3426	Amp	
No. of parallel cables /ph	6		Adjusted Ampacity	2741	Amp	
No. of breakers/cable (bp)	9			3141	Amp	
Phase area	300	mm2		3450	Amp	



مع فرضية أن كل الاحمال مسمرة

ND1

(1.25 RULE)

Derating factor = 0.8, 400V 3PH

Cable size selection VA =====>

=all demand loads X 1.25 = 2055 KVA

=====>cable 6 parallel 400 MM<sup>2</sup>

Breaker size selection VA =====> = all demand loads X 1.25 = 2055 KVA

=====> breaker 3200 A

Transformer size selection KVA =====> = all demand loads X 1.25 = 2055 KVA ==> nearest transformer size 2500KVA

Design Load after Cont. & non-cont. loads .	2055			Conductor type	Copper
				Total Correction factor	KT 0.8
CABLE AND CIRCUIT BREAKER SELECTION					
Current after derating (Amp)	2970			Cable selection current (Amp)	3712
Circuit breaker size	3200	AT		C.B selection current(Amp)	2970
Cable size	400	mm <sup>2</sup>			3200 AF
No. of parallel cables /ph	6			Total catalogue Ampacity	3990 Amp
				Adjusted Ampacity	3192 Amp
					3185
					3000

ND1 J L 3 A